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Prevalence of Vitamin D Deficiency in Prediabetes and its Correlation with Glycemic Indices: A Cross- Sectional Pilot Study.

Munibuddin M Ahmed[1]*, Urjita S Zingade[2], Khaled M Badaam[2], and Samina T Khan[2].

[1]Department of Physiology, Govt. Medical College, Aurangabad, Maharashtra, India.
[2]Department of Physiology, BJ Medical College, Pune, India.

ABSTRACT

Vitamin D deficiency has been considered to be a contributing factor in glucose intolerance. The aim of the study was to determine the prevalence of vitamin D deficiency in Prediabetes & study the correlation of vitamin D levels with concentrations of HbA1c, insulin & glucose. Forty known subjects aged 25 to 60 years diagnosed with Prediabetes as per American Diabetes Association criteria were enrolled. Fasting vitamin D levels were assessed for deficiency status in all the subjects. Among vitamin D deficient subjects correlation of vitamin D levels with HbA1c, fasting glucose, fasting insulin was done. Blood samples were also taken for glucose & insulin evaluation after one and a half hours of giving 75 grams glucose & these glucose & insulin levels were correlated with vitamin D levels. Mean age of subjects was 39.8 ± 8.74 years. The proportion deficient in Vitamin D was 0.875 (95% CI: 0.739 to 0.945). However, there was no significant correlation found between Vitamin D levels & HbA1c, fasting glucose, fasting insulin & post meal glucose, post meal insulin with r values of -0.036, 0.031, 0.1, 0.063, -0.076 respectively. Very high prevalence of vitamin D deficiency was found in Prediabetes subjects. However there was no significant correlation found between vitamin D levels & glycemic indices.

Keywords: Fasting blood glucose, glycated haemoglobin, Hypovitaminosis D

Corresponding author

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INTRODUCTION

Vitamin D deficiency is considered to be a contributing factor in glucose intolerance [1, 2]. It is now being included as an independent risk factor for metabolic syndrome and Diabetes [3]. Prediabetes is an earlier stage in diabetes and prevention strategies like lifestyle modification or pharmacologic treatment intervention have been reported to be useful in the prevention or delay in the progression to diabetes [4, 5]. The present study was a pilot study to determine the prevalence of vitamin D deficiency in Prediabetes & study the correlation of vitamin D levels with concentrations of HbA1c, insulin & glucose.

MATERIAL AND METHODS

This was a cross sectional study. Institutional ethics committee approval was taken prior to commencement of the study. Forty subjects aged 25 to 60 years diagnosed with Prediabetes as per American Diabetes Association criteria [6] were enrolled by convenience sampling from various diabetes practitioners in the city. Subjects with hypercalcaemia, vitamin D supplementation therapy for osteoporosis, orthopaedic disorders like osteomalacia, rickets, end stage kidney failure, pregnancy were not included. . Informed consent was taken from all the study subjects. Parameters like age, weight and height were recorded and Body mass index was calculated. Fasting vitamin D levels i.e. 25(OH) D were assessed for deficiency status in all the subjects and its correlation with HbA1c, fasting glucose, fasting insulin was done. Blood samples of glucose & insulin were also taken after one and a half hours of giving 75 grams of glucose & these post meal levels were correlated with vitamin D. Plasma glucose was measured by GOD-POD method. HbA1c was measured by the BIO-RAD D-10 Dual program for the percent determination of glycated haemoglobin in human whole blood using high-performance liquid chromatography. Plasma insulin was measured by electrochemiluminescence immunoassay “ECLIA ’’using cobas e 411. Vitamin D was also estimated by electrochemiluminescence immunoassay “ECLIA ’’using cobas e 411.

Vitamin D deficiency was defined as a 25(OH)D below 20 ng/ml and vitamin D insufficiency as a 25(OH) D of 21–29 ng/ml whereas 25(OH) D of 30 ng/ml or more was considered to be normal as per recommendations. Severe vitamin D deficiency was defined as a 25(OH) D less than 10 ng/ml [7]. Analysis was done on Microsoft Excel 2007.

RESULTS

Thirty five out of forty subjects were found to be having Hypovitaminosis D. The proportion of subjects with vitamin D deficiency was 0.875 (95% CI: 0.739 to 0.945). Thus, 87.5% individuals with Prediabetes had vitamin D deficiency in our study group. All of them had vitamin D levels below 20 ng/ml. Out of these, nineteen subjects had severe vitamin D deficiency with serum 25 hydroxy vitamin D levels below 10 ng/ml. Among the vitamin D deficient group, further analysis for correlation with glycemic indices was done.

Table 1 shows baseline characteristics and vitamin D levels of the study group.

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Table 1: Baseline characteristics and vitamin D levels of the study group.

Parameter	Mean ± Standard Deviation
Age (years)	39.8 ± 8.74
Weight (kilograms)	68.19 ± 14.6
Height (metres)	1.61 ± 0.09
Body Mass Index (kilograms/metre^2)	26.07 ± 3.61
Vitamin D levels (nanograms/millilitre)	10.35 ± 3.33

There was no significant correlation found between Vitamin D levels & HbA1c, fasting glucose, fasting insulin, post meal glucose, post meal insulin.

Table 2 shows the glycemic indices along with its correlation coefficient with vitamin D levels in the vitamin D deficient group.

Table 2: Correlation of vitamin D levels and glycemic indices in Prediabetes subjects with Hypovitaminosis D

Parameter	Mean ± Standard Deviation	Correlation coefficient with vitamin D levels [r value, (p value)]
HbA1c (%)	5.73 ± 0.36	-0.036 (0.84)*
Fasting Glucose (mg/dl)	109.40 ± 7.86	0.031 (0.86) *
Fasting Insulin (µIU/ml)	4.75 ± 3.311	0.1 (0.57) *
Post Meal Glucose (mg/dl)	47.31 ± 28.48	0.063 (0.72) *
Post Meal Insulin (µIU/ml)	50.10 ± 28.47	-0.076 (0.66) *

***Statistically not significant**

DISCUSSION

Our data shows that among the Prediabetes subjects, Vitamin D deficiency was very high i.e. 87.5% using the cut-off value of less than 20 ng/ml. Earlier studies from India have also reported vitamin D deficiency to be very common in subjects with type 1 diabetes, type 2 diabetes and Prediabetes. Dutta et al [8] have reported that vitamin-D deficiency or insufficiency was 73.25% in Prediabetes, 66.6% in diabetes and that the prevalence of severe vitamin-D deficiency (<10 ng/ml) was almost twice for subjects with Prediabetes when compared with normal and the diabetic study groups. Some other studies have also found results which were in line with their study [9, 10].

When vitamin D levels were correlated with glycated haemoglobin, there was no significant relation found from our data. Correlation studies between vitamin D and HbA1c have given variable results. Earl et al found no significant association between vitamin D and HbA1c [11]. Jatupol et al reported vitamin D3 and HbA1c to be having inverse correlation however this relation was age related. It was found in the 35-74 years age group but not in the age group of 18-34 years [12]. Micah et al study reported no significant correlation of vitamin D3 level with HbA1c in the obese children [13]. A weak association between vitamin D3 and glycated haemoglobin was found in a New Zealand study done in overweight & obese adults above 18 years of age [14]. Alemzadeh et al reported a significant relationship between vitamin D and HbA1c in Caucasians but it was not found in African Americans [15]. Thus, the relation of vitamin D with HbA1c is dependent on various factors and remains to be further explored.

There was no significant correlation found between vitamin D and fasting as well as post meal glucose and insulin levels. Recently, a large study done in Thailand young population also found that there was no correlation between vitamin D and fasting glucose after adjustment for confounding factors [16]. Similarly, a Malaysian study also found no correlation between vitamin D and fasting glucose [17]. However, conflicting results are also reported in some studies from Asia [18, 19]. The results from an Indian study indicated that there was no correlation between vitamin D and fasting as well as post meal glucose [20]. In relation to insulin levels, a negative correlation has been reported earlier [21].

Our study has given the pilot data from western India, however, there are various limitations including a small sample size and cross-sectional nature of the study. Considering that India is fast becoming the diabetic capital of world, there is an urgent need to identify high risk groups and associated factors. Larger and longitudinal studies need to be conducted across various centres in India to ascertain the role of vitamin D in progression to diabetes.

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